

Short Communication

**Length-Weight Relationship and Condition Factor of *Puntius stigma*
from Chanda Beel, Gopalganj**

G. Sarker, M.M. Khatun and M.N. Ahsan*

Length–weight relationship is very important for scientific culture and management of fish. The relationship has great biological interest as it helps to determine the mathematical relationship between the two variables and to calculate the variation from the expected weight for length of individual or groups of fishes (Le Cren, 1951). Measurement of fork length relationship is extremely used in the identification of fish up to species level (Hoque and Rahaman, 1985). On the other hand, the condition factor serves as a useful index of the nutritional and biological cycle including gonadal development and spawning of the species (Jhingran, 1972). This has been used to test the suitability of an environment for a particular species by comparing two or more populations of the fish from different localities (Le Cren, 1951). Furthermore, it is also helpful in assessing experimental improvement of an environment for existing and new fish stock (Cooper and Benson, 1951).

Puntius stigma being small in size is widely caught and consumed by the common people. While the fish contains 18.95% protein, 6.27% lipid, 72.97% moisture on a wet weight basis (Nurullah *et al.*, 2003), it is particularly noted for its excellent vitamin and mineral sources: 37 ± 16 µg vitamin A and 1059 ± 161 mg calcium (Wahab, 2003).

The length-weight relationship of any species may vary from area to area and can be used to test the suitability of an environment for a particular species by comparing different populations of the same species from different geographic regions. Although Islam and Hossain (1991) studied on length-weight relationship and condition factor of *P. stigma* found in Rajshahi, the present study was carried out to determine length-weight relationship and condition factor of *P. stigma* from Chanda beel, one of the famous water bodies situated in Gopalganj.

A total of 152 fish samples were collected randomly from Chanda beel, Muksudpur, Gopalganj during the breeding season (August-September) of *P. stigma*. For the biological studies the length and weight of each specimen was recorded separately to the nearest 0.1 cm and gm, respectively. The excess water attached to the fish was removed with the help of blotting paper before taking body weight (W) by a sensitive electrical balance. The length was measured with the help of a measuring board and steel measuring tape and scale by placing the sample on it. All these materials were brought to the field spot for immediate measurement. Total length (TL) was measured from the anterior most extremity to the longest ray of the caudal fin whereas standard length (SL) was measured from the anterior most extremity to the base of the caudal fin. On the other hand, fork length (FL) of the specimen was measured from the anterior most extremity to the median rays of the tail.

The data were fitted into Le Cren's (1951) formula $W = aL^n$ or logarithmically $\text{Log}W = \text{Log}a + n\text{log}L$ where W = weight of fish, L = Length (TL/SL/FL) of fish, a = intercept and n = regression co-efficient.

As the total length and fork length measurement might at times be erroneous due to damaging or breaking caudal fin rays, the standard length was chosen to measure the condition factor (K) and relative condition factor (Kn) to avoid inaccuracy in the measurement. The value of K was measured by both observed values and calculated values. Hence, the data of length were arranged in 3 cm interval.

The relative condition factor was also determined by the following formula given by Le Cren (1951):

$$\text{Relative condition factor (Kn)} = \frac{\text{Observed body weight in gm}}{\text{Calculated body weight}}$$

The condition factor (K) was calculated with the help of the formula given by Dewan and Doha (1973):

$$K = \frac{W \cdot 10^2}{L^3} \quad \text{where } W = \text{weight in gm, } L = \text{length in cm}$$

Scatter diagrams with correlation coefficient (r) of total length versus weight, standard length versus weight and fork length versus weight are shown in Figs. 1 to 3. In all types of relationship, straight line was found when data of length were plotted against their corresponding weights on both arithmetic and logarithmic scales. A straight line was also found when the data of total length and weight as well as standard length and weight of *Setipinna phasa* (Kamal *et al.*, 1999), total length and body weight of *Catla catla* (Salam and Mahmood, 1993) and *Labeo bata* (Azadi and Naser, 1996) were plotted on logarithmic scale, while smooth growth curve was obtained on arithmetic scale.

The equations of Total length (TL) versus Weight (W); Standard length (SL) versus Weight (W) and Fork length (FL) versus Weight (W) for *P. stigma* in the present study were found to be as follows:

(a) Total length vs. Weight:

$$W = -18.138 + 3.3485 \text{ TL} \quad (r = 0.8999, t = 1.9034) \text{ [Fig. 1a.]}$$

$$\text{or } \log W = -1.6458 + 2.854 \log \text{ TL} \quad (r = 0.9905, t = 6.67) \text{ [Fig. 1b.]}$$

(b) Standard length vs. Weight:

$$W = -15.942 + 3.8534 \text{ SL} \quad (r = 0.8403, t = 1.335) \text{ [Fig. 2a]}$$

$$\text{or } \log W = -1.2694 + 2.7295 \log \text{ SL} \quad (r = 0.98934, t = 5.802) \text{ [Fig. 2b.]}$$

(c) Fork length vs. Weight:

$$W = -17.129 + 3.573 \text{ FL} \quad (r = 0.8785, t = 1.325) \text{ [Fig. 3a.]}$$

$$\text{or } \log W = -1.1958 + 2.518 \log \text{ FL} \quad (r = 0.981723, t = 3.71) \text{ [Fig. 3b.]}$$

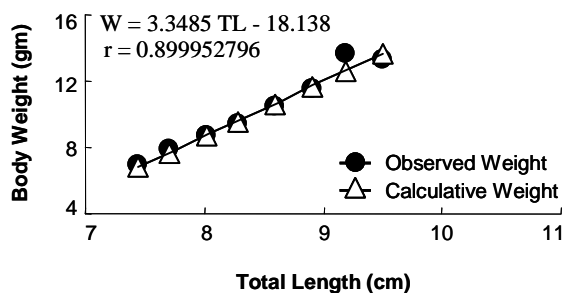


Fig.1a. Arithmetic relationship between total length (TL) and body weight (W)

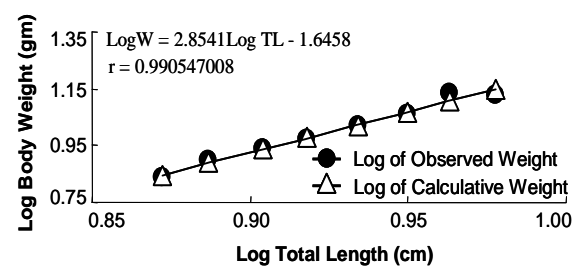


Fig.1b. Logarithmic relationship between total length (TL) and body weight (W)

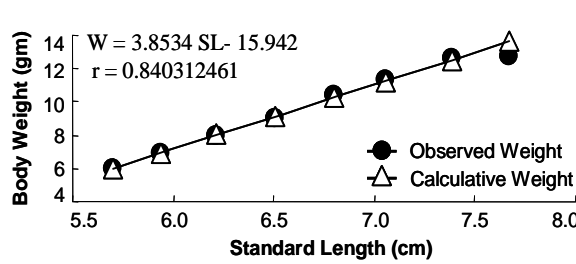


Fig. 2a. Arithmetic relationship between standard length (SL) and body weight (W)

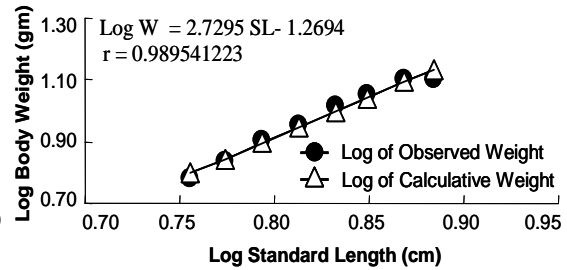


Fig. 2b. Logarithmic relationship between standard length (SL) and body weight (W)

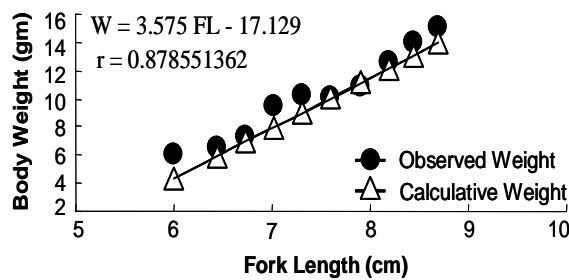


Fig. 3a. Arithmetic relationship between fork length (FL) and body weight (W)

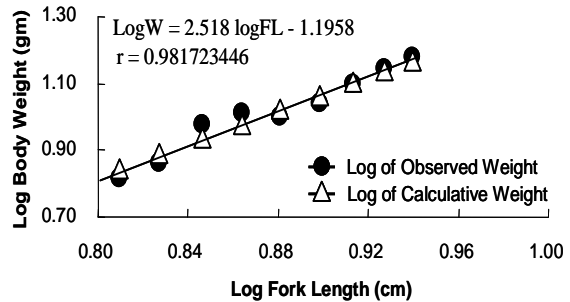


Fig. 3b. Logarithmic relationship between fork length (FL) and body weight (W)

The length weight relationship found for *P. stigma* in the present study was almost similar to those obtained for *Labeo gonius* and other *Puntius* species. The equation of length-weight relationship for *Labeo gonius* was found to be $\log W = -5.1967 + 3.1586 \log L$ (Chondar, 1972) whereas $\log W = -4.539 + 2.847 \log L$ and $\log W = -5.2233 + 3.2051 \log L$ equations were obtained for *P. stigma* (Islam and Hossain, 1991) and *P. chola* (Bhuiyan and Biswas, 1982), respectively.

The values of 'n' obtained from TL-W, SL-W and FL-W equations were also compared in a t test and it was found that the differences in the values of 'n' were significant at 95% confidence limit. Thus, any one of the above equations could be used to convert from weight to length and vice versa.

The regression co-efficient 'n' was slightly less than 3 (2.6652 to 2.8093) that closely follow the 'cube law' i.e. isometric growth to be expected. The value of 'n' is slightly higher (2.84) in *P. stigma* of Rajshahi (Islam and Hossain, 1991). This difference in the value of 'n' may be due to geographical difference or this could be due to a small number of fish being studied. Similarly, Kamal *et al.* (1999) also found close isometric growth pattern in *S. phasa*.

The value of correlation coefficient 'r' was found to vary from 0.8403 to 0.9905. All types of relationships on logarithmic scale showed highly correlated relationship between length and weight and moderately high on arithmetic scale of the fish. This finding support the 'r' value reported for *P. stigma* from Rajshahi (0.97; Islam and Hossain, 1991). A highly correlated relationship was also found in *Tor putitora* as 'r' = 0.965 (Islam *et al.*, 2002) and *Heteropneustes fossilis* as 'r' = 0.93 (Faruq *et al.*, 1998).

For observed values, the condition factor ranged from 2.81 to 3.33 with the mean of $3.20375 \pm SD 0.169532$. The mean calculated condition factor was $3.225 \pm SD 0.110454$ with a range of 3.02 to 3.34. The Kn values also ranged from 0.9312 to 1.01 (mean $0.99225 \pm SD 0.025786$; Fig. 4).

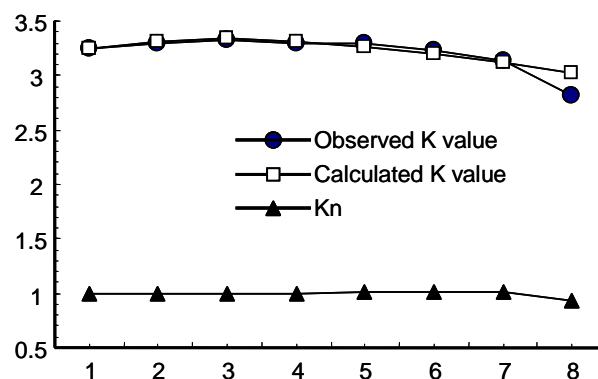


Fig.4. Condition factor (K) for observed value, calculated value and relative condition factor (Kn) of *Heteropneustes fossilis*.

This poor figures in Kn values may be due to either small sample size, different maturity stages, partial spawning, difference in weight of undigested food in alimentary canal or changes in the fat content in the body tissue (Jhingran, 1972) which is subject for further study.

Islam and Hossain (1991) determined the value of K and Kn of *P. stigma* from Rajshahi. The value of K are for observed values, male: range - 1.34 to 1.42, mean - 1.43; female: 1.42 to 1.50, mean - 1.43, for calculated values, male: range - 1.36 to 1.47, mean - 1.41; female: 1.37 to 1.83, mean - 1.60. In this previous study of *P. stigma*, there is a serious error that the mean exceeds maximum value in male for observed condition factor which is also another reason to conduct the present study. The Kn values ranges from 0.95 to 1.04 in males, 0.89 to 1.06 in females and 0.96 to 1.10 in combined males-females with a mean of 1.00, 0.96 and 1.00, respectively. The variation of the value of K and Kn between present and previous study may be due to geographical variation. The fluctuation of condition factors in different groups may be attributed to spawning and following recovery, gonadal development and also also on the general condition of seasonal appetite (Dewan and Doha, 1973). However, the factors like environment, food and parasitism influence K directly through growth rate. Seasonal fluctuations in feeding activity, gonadal development and growth can also bring changes in the value of K (Le Cren, 1951). However, the condition factor and relative condition factor of different species other than *P. stigma* in previous research work are given in Table 1.

REFERENCES

- Azadi MA and Naser A. 1996. Length-weight relationship and relative condition factor of a carp, *Labeo bata* (Ham.) from Kaptai reservoir, Banglades. Chittagong University Studies Part II: Science. 20(2):19-25.
- Bhuiyan AS and Biswas B. 1982. Studies on the morphometry of *Puntius chola* (Hamilton-Buchnan) (Cyprinidae : Cypriniformes). Univ. J. Zool. Rajshahi Univ. 1:29-34.
- Chondar SL. 1972. Length-weight relationship of mature female *Labeo gonius* (Hamilton) from the keetham reservoir. J. Inland Fish. Soc. India. IV:216-217.
- Cooper EL and Benson NG. 1951. The coefficient of condition of brook, brown and rainbow trout in the Pigeon River, Ostego Country, Michigan. Prog. Fish Cult. 13:181-192.
- Dewan S and Doha S. 1973. Studies on the biology of *Tilapia mossambica*-111. Length-weight relationship and condition factor. Pakistan J. Sci. 19 (1-2):14-12.

- Faruq MA, Saha JK, Miah MI and Rahmatullah SM. 1998. Fecundity, length-weight relationship and condition factor in *Heteropneustes fossilis* (Bloch). Bangladesh J. Fish. 21(1):77-81.
- Hoque B and Rahaman MK. 1985. Morphometric characters and their relationships in *Gadusia chapra* (Ham.) (Cupeiformes: Clupeidae). Chittagong University Studies Part II: Science. 9(2):85-88.
- Islam MS and Hossain MA. 1991. Length-weight relationship and condition factor of common punti, *Puntius stigma* (Cuvier & Valenciennes) (Cyprinidae : Cypriniformes). Univ. J. Zool. Rajshahi Univ. 10 & 11: 109 - 110.
- Islam MS, Dewan S, Hussain MG, Hossain MA and Mazid MA. 2002. Length-weight relationship and relative condition factor of pond-reared mahseer, *Tor putitora* (Ham.). Bangladesh J. Fish. Res. 6(2):159-164.
- Jhingran AG. 1972. Fluctuations in the ponderal index of the Gangetic anchovy, *Setipinna phasa* (Hamilton) from the Ganga river system. Journal of Inland Fisheries Society of India. 5: 14-19.
- Kamal D, Alam MJ and Mehedi MY. 1999. Length-weight relationship and condition factor in *Setipinna phasa* (Hamilton-Buchanan) from the Bay of Bengal, Bangladesh. Khulna University Studies. 1(1): 81-88.
- LeCren AH. 1951. The length-weight relationship and seasonal cycle in gonad weight and condition in the perch *Perca fluviatilis*. Journal of Animal Ecology. 20: 201-219.
- Nurullah M, Kamal M, Wahab MA, Islam MN, Ahsan CT and Thilsted SH. 2003. Nutritional quality of some small indigenous fish species of Bangladesh. In: Small indigenous species of fish in Bangladesh. Culture potentials for improved nutrition and livelihood (edited Wahab MA, Thilsted SH and Hoq ME). Bangladesh Agricultural University, Mymensingh, Bangladesh, ENRECA/DANIDA, 2003.
- Salam A and Mahmood JA. 1993. Weight-length and condition factor relationship of a fresh water under yearling wild *Catla catla* (Hamilton) from river Chenab (Multan). Pakistan J. Zool. 25(2):127-130.
- Wahab MA. 2003. Small indigenous fish species of Bangladesh: Potentials for culture and conservation. In: Small indigenous species of fish in Bangladesh. Culture potentials for improved nutrition and livelihood (edited Wahab MA, Thilsted SH and Hoq ME). Bangladesh Agricultural University, Mymensingh, Bangladesh, ENRECA/DANIDA, 2003.